

WHAT IS CLAIMED IS:

1 1. An apparatus for spatially homogenizing electromagnetic energy
2 transmitted from different sources for measuring a physiological parameter, comprising:
3 a first inlet for receiving electromagnetic energy transmitted from a first
4 source;
5 a second inlet for receiving electromagnetic energy transmitted from a second
6 source;
7 means for spatially homogenizing the electromagnetic energy transmitted from
8 the first source with the electromagnetic energy transmitted from the second source to form a
9 spatially-homogenized multi-source electromagnetic energy; and
10 an outlet for delivering the spatially-homogenized multi-source
11 electromagnetic energy to a tissue location for measuring the physiological parameter.

1 2. The apparatus of claim 1 wherein said means for spatially
2 homogenizing comprises
3 a first bundle of optical fibers having a first proximal end originating at said
4 first inlet and a first distal end terminating at said outlet;
5 a second bundle of optical fibers having a second proximal end originating at
6 said second inlet and a second distal end terminating at said outlet;
7 wherein at said outlet each first distal end of each fiber of said fibers of said
8 first bundle is spatially mixed with each second distal end of each fiber of said fibers of said
9 second bundle, so as to form a spatially-homogenized multi-source electromagnetic energy
10 received from said first and said second inlets.

1 3. The apparatus of claim 2 further comprising a cladding surrounding
2 said first bundle and said second bundle of optical fibers, said cladding having a first cladding
3 proximal end at said first inlet, a second cladding proximal end at said second inlet and a
4 cladding outlet at said outlet.

1 4. The apparatus of claim 1 wherein the first source transmits
2 electromagnetic energy in a first spectral region,
3 the second source transmits electromagnetic energy in a second spectral
4 region,

5 and the spatially-homogenized multi-source electromagnetic energy is a
6 spatially-homogenized multi-spectral electromagnetic energy.

1 5. A sensor for measuring a physiological parameter in a blood-perfused
2 tissue location, comprising:

3 a first source of electromagnetic energy configured to direct radiation at said
4 tissue location;

5 a second source of electromagnetic energy configured to direct radiation at
6 said tissue location;

7 an apparatus for spatially homogenizing electromagnetic energy transmitted
8 from said first and second sources, said apparatus comprising

9 a first inlet for receiving electromagnetic energy transmitted from said first
10 source;

11 a second inlet for receiving electromagnetic energy transmitted from said
12 second source;

13 means for spatially homogenizing said electromagnetic energy transmitted
14 from said first source with said electromagnetic energy transmitted from said second source
15 to form a spatially-homogenized multi-source electromagnetic energy; and

16 an outlet for delivering said spatially-homogenized multi-source
17 electromagnetic energy to said tissue location; and

18 light detection optics configured to receive said spatially-homogenized multi-
19 source electromagnetic energy from said tissue location for measuring the physiological
20 parameter.

1 6. The sensor of claim 5 wherein said means for spatially homogenizing
2 comprises

3 a first bundle of optical fibers having a first proximal end originating at said
4 first inlet and a first distal end terminating at said outlet;

5 a second bundle of optical fibers having a second proximal end originating at
6 said second inlet and a second distal end terminating at said outlet;

7 wherein at said outlet each first distal end of each fiber of said fibers of said
8 first bundle is spatially mixed with each second distal end of each fiber of said fibers of said
9 second bundle, so as to form a spatially-homogenized multi-source electromagnetic energy
10 received from said first and said second inlets.

1 7. The sensor of claim 6 further comprising a cladding surrounding said
2 first bundle and said second bundle of optical fibers, said cladding having a first cladding
3 proximal end at said first inlet, a second cladding proximal end at said second inlet and a
4 cladding outlet at said outlet.

1 8. The sensor of claim 5 wherein said first source transmits
2 electromagnetic energy in a first spectral region,
3 said second source transmits electromagnetic energy in a second spectral
4 region,
5 and said spatially-homogenized multi-source electromagnetic energy is a
6 spatially-homogenized multi-spectral electromagnetic energy.

1 9. The sensor of claim 8 wherein said first source and said second source
2 are configured to transmit electromagnetic energy in the range approximately between 500
3 and 1850 nm.

1 10. The sensor of claim 8 wherein said first source is configured to
2 transmit electromagnetic energy in essentially the red region of approximately 660 nm.

1 11. The sensor of claim 8 wherein said second source is configured to
2 transmit electromagnetic energy in essentially the infrared region of approximately between
3 890-940 nm.

1 12. The sensor of claim 5 wherein said sensor is an oximeter sensor.